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EXAMINER

GOUDREAU, GEORGE A

ART UNIT PAPER NUMBER

1763

DATE MAILED: 05/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09-846,119

Applicant(s)

Gilman et al

Examiner

George Goudreau

Group Art Unit

1763

— The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address —

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on (2-03' to 3-03') (i.e., papers # 6-7)

☒ This action is **FINAL**.

- ☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-16, 19, 22-27, 29-30 is/are pending in the application.

Of the above claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-16, 19, 22-27, 29-30 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

- ☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.
- ☐ The drawing(s) filed on _____ is/are objected to by the Examiner
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

- ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____.

☐ Copies of the certified copies of the priority documents have been received

in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____

Attachment(s)

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 3

☐ Interview Summary, PTO-413

☒ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

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15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

17. Claims 1-16, 19, 22-27, and 29-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen (6,063,689) further in view of Vo et. al. (6-00'), and Liu (6,218,267).

Chen et. al. disclose a process for forming an STI structure (124) on the surface of a wafer (100) which is comprised of the following steps:

-A bilayer mask (102, 104) is formed onto the surface of the Si wafer. Layer 102 is comprised of a pad SiO₂ layer. Layer 104 is comprised of Si₃N₄. The bilayer mask is then patterned to form an etch mask.;

-The bilayer etch mask is then used in the etching of a trench in the Si wafer (100).;

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-A SiO₂ layer (116) is used to planarize the surface of the wafer as well as to fill the trench etched into the Si wafer.;

-The SiO₂ layer (116) is then planarized, and etched using a two step process. During the first step, the SiO₂ layer is cmp polished to planarize it. The planar SiO₂ layer is then etched back in a plasma until the surface of the polysi layer (104) is reached which functions as a type of etch stop.; and

-The polysi, and SiO₂ etch mask is then removed from the surface of the wafer using an etching process to leave behind an STI structure on the surface of the wafer.

This is discussed specifically in columns 3-4; and discussed in general in columns 1-6.

This is shown in figures 1-2. Chen et. al. fail, however, to disclose the following aspects of applicant's claimed invention:

-the specific usage of a fixed abrasive pad, and a cmp slurry which contains no free floating abrasive particles to cmp polishing the surface of the SiO₂ layer in the process taught above;

-the reduction of the thickness of the SiO₂ fill layer to the specific thicknesses which are claimed by the applicant in the cmp polishing step;

-the specific formation of the etch mask layer used to form the trench in the Si wafer out of a SiO₂ pad layer/ a Si₃N₄ pad layer; and

-the formation of the Si₃N₄ etch mask layer to the specific thicknesses which are claimed by the applicant

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Vo et. al. teach it is desirable to use a fixed abrasive cmp polishing pad in combination with a cmp slurry which contains no free floating abrasive particles when selectively cmp polishing a SiO₂ layer to an underlying Si₃N₄ layer on a wafer in order to reduce the amount of over polishing of the Si₃N₄ polish stop which would be obtained as compared to a conventional cmp polishing process which employs an abrasive free polishing pad in combination with a cmp slurry which contains free floating abrasive particles. This is discussed on pages 123-128.

Liu teaches that it is desirable to use a SiO₂ pad layer/ Si₃N₄ pad layer as an etch mask when forming STI trench in a CZ-Si wafer. This is discussed specifically in column 3; and discussed in general in columns 1-4. This is shown in figures 1-10.

It would have been obvious to one skilled in the art to conduct the cmp polishing process of Chen et. al. as taught above employing a fixed abrasive cmp polishing pad in combination with a cmp slurry which contains no free floating abrasive particles based upon the teaching of Vo et. al. that it is desirable to do so for reasons of reduced over polishing of the Si₃N₄ polish stop layer during the cmp polishing of the SiO₂ layer.

It would have been obvious to one skilled in the art to form the etch mask used in the etching of the STI trench in the Si wafer in the process taught above out of a combination of a SiO₂ pad layer/ Si₃N₄ pad layer based upon the teachings of Liu that it is desirable to do so. Further, this simply represents the usage of an alternative, and at least equivalent means for forming an etch mask in the process taught above to those means which are specifically taught above.

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It would have been obvious to one skilled in the art to cmp polish the SiO₂ layer in the process taught above until the thickness is reduced to the specific thicknesses which are claimed by the applicant base upon the following. It would have been obvious to one skilled in the art to use the cmp polish step to a sufficient extent to adequately, and rapidly planarize the surface of the SiO₂ layer without undesirably exposing the surface of the underlying layer based upon the teachings in this reference regarding these matters.

It would have been obvious to one skilled in the art to form the Si₃N₄ etch mask in the process taught above to the specific thicknesses which are claimed by the applicant based upon the following. It would have been obvious to one skilled in the art to form adequate thickness to the Si₃N₄ layer in the process taught above such that an adequate level of protection is provided to the underlying layers during each etching step without forming an inordinately thick layer of material which would adversely effect processing costs, and processing times for fabricating the device.

18. Claims 1-16, 19, 22-27, and 29-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen (6,136,713) further in view of Vo et. al. (6-00'), and Liu (6,218,267).

Chen et. al. disclose a process for forming an STI structure (206 b) on the surface of a wafer (200) which is comprised of the following steps:

- A Si₃N₄ etch mask (202) is formed onto the surface of the Si wafer.;
- The Si₃N₄ etch mask is then used in the etching of a trench in the Si wafer (200).;

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-A SiO₂ layer (206) is used to planarize the surface of the wafer as well as to fill the trench etched into the Si wafer.; and

-The SiO₂ layer (206) is then planarized, and etched using a two step process. During the first step, the SiO₂ layer is cmp polished to planarize it. The planar SiO₂ layer is then etched back in a plasma until the surface of the Si₃N₄ layer (202) is reached which functions as a type of etch stop.

This is discussed specifically in columns 3-4; and discussed in general in columns 1-6.

This is shown in figures 1-2. Chen et. al. fail, however, to disclose the following aspects of applicant's claimed invention:

- the specific usage of a fixed abrasive pad, and a cmp slurry which contains no free floating abrasive particles to cmp polishing the surface of the SiO₂ layer in the process taught above;
- the reduction of the thickness of the SiO₂ fill layer to the specific thicknesses which are claimed by the applicant in the cmp polishing step;
- the formation of the Si₃N₄ etch mask layer to the specific thicknesses which are claimed by the applicant; and
- the specific formation of the etch mask layer used to form the trench in the Si wafer out of a SiO₂ pad layer/ a Si₃N₄ pad layer

It would have been obvious to one skilled in the art to conduct the cmp polishing process of Chen et. al. as taught above employing a fixed abrasive cmp polishing pad in combination with

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a cmp slurry which contains no free floating abrasive particles based upon the teaching of Vo et. al. that it is desirable to do so for reasons of reduced over polishing of the Si₃N₄ polish stop layer during the cmp polishing of the SiO₂ layer.

It would have been obvious to one skilled in the art to form the etch mask used in the etching of the STI trench in the Si wafer in the process taught above out of a combination of a SiO₂ pad layer/ Si₃N₄ pad layer based upon the teachings of Liu that it is desirable to do so. Further, this simply represents the usage of an alternative, and at least equivalent means for forming an etch mask in the process taught above to those means which are specifically taught above.

It would have been obvious to one skilled in the art to cmp polish the SiO₂ layer in the process taught above until the thickness is reduced to the specific thicknesses which are claimed by the applicant base upon the following. It would have been obvious to one skilled in the art to use the cmp polish step to a sufficient extent to adequately, and rapidly planarize the surface of the SiO₂ layer without undesirably exposing the surface of the underlying layer based upon the teachings in this reference regarding these matters.

It would have been obvious to one skilled in the art to form the Si₃N₄ etch mask in the process taught above to the specific thicknesses which are claimed by the applicant based upon the following. It would have been obvious to one skilled in the art to form adequate thickness to the Si₃N₄ layer in the process taught above such that an adequate level of protection is provided to the underlying layers during each etching step without forming an inordinately thick layer of

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material which would adversely effect processing costs, and processing times for fabricating the device.

19. Applicant's arguments filed 11-25-02' have been fully considered but they are not persuasive.

Applicant argues the following points regarding the examiner's rejection of their claimed subject matter.

-Applicant argues that there are several features of their claimed invention which the examiner has previously stated were conventionally used or at least well known in the prior art which are actually not conventional known.

The examiner must disagree.

-The examiner has now supplied references in his rejection of applicant's newly amended claims which establishes that certain features of applicant's claimed invention were conventionally used or at least well known in the prior art.

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period

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will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner George A. Goudreau whose telephone number is (703) -308-1915. The examiner can normally be reached on Monday through Friday from 9:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Examiner Gregory Mills, can be reached on (703) -308-1633. The appropriate fax phone number for the organization where this application or proceeding is assigned is (703) -306-3186.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) -308-0661.


George A. Goudreau/gag

Primary Examiner

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